

DEPARTMENT OF ECONOMICS

WORKING PAPER SERIES

2008-06



McMASTER UNIVERSITY

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The Impact of Social Value Orientation and Risk Attitudes on Trust and Reciprocity

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7 August 2008

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Abstract

Prior experimental studies provide evidence that the levels of trust and reciprocity are highly susceptible to individuals' preferences towards payoffs, prior experience, capacity to learn more about personal characteristics of each other and social distance. The objective of this study is to examine whether social value orientation as developed by Griesinger and Livingstone (1973) and Liebrand (1984) and risk preferences can help to account for the variability of trust and trustworthiness. We use the Berg et al. (1995) investment game to generate indices of trust and reciprocity. Prior to their participation in the investment game, all subjects participated in two other games. One is used to measure their social value orientation (a measure of other regarding behavior) and the second to measure risk attitudes. These variables are introduced as treatments in the analysis of the trust and reciprocity data. In addition to these preference related variables, gender is introduced to capture any differences between men and women which may not be encompassed by value orientation and risk attitudes. The statistical analysis indicates that the social value orientation measure significantly accounts for variation in trust and reciprocity. As well, the level of trust exhibited by an investor significantly affects the reciprocity of the responders and this measure of trust interacts with social value orientation. Individuals who are highly pro-social reciprocate more as the sender's trust increases, while those who are highly pro-self reciprocate less as the sender's trust increases. For this sample of participants, the gender variable does not capture any differences in the behavior of men and women that is not already reflected by the differences captured by their value orientations. Risk attitudes do not significantly account for variation in trusting behavior, except for the case where individuals have neither strongly pro-social nor pro-self social value orientations. In this case, more risk-seeking individuals are more trusting.

Key Words: Trust, Reciprocity, Social Value Orientation, Risk Attitudes, Gender

PsycINFO Classification Code: 2910, 3020

JEL Classification Code: C92, D81, Z13

The Impact of Social Value Orientation and Risk Attitudes on Trust and Reciprocity

1. Introduction

Arrow (1974) stresses the ubiquity of trust (as a transaction cost depressant) in almost every economic transaction. He finds that higher rates of investment and growth are positively associated with higher levels of trust. More recently, Dincer and Uslander (2007) show that a 10% increase in trust leads to a 0.5% increase in the growth rate of per capita income. For more than a decade, researchers have been examining trust and reciprocity issues in a behavioral game context. The most common artifact for this work is the trust (investment) game in a one-shot setting (see for example, Berg et al., 1995; Croson and Buchan, 1999; Cox and Deck, 2006).

Many experimental studies (see for example, McCabe et al., 2003; Cox and Deck, 2006) have shown that measures of trust and trustworthiness are highly variable and are associated with various factors such as individual preferences towards payoffs, prior experience, a player's capacity to learn more about personal characteristics of each other and social distance. In these experiments, various contextual factors associated with the structure of the experiments are manipulated to partially explain the variance in the levels of trust and trustworthiness.

In addition to the above factors, social preferences may also influence both trusting and reciprocal behavior. According to Croson and Gneezy (2004), social preference is modeled in the economic literature in a number of ways, including altruism (Becker, 1974; Andreoni, 1989), envy (Mui, 1995), inequality-aversion (Bolton, 1991; Bolton and Ockenfels, 2000) and reciprocity (Rabin, 1993; Charness and Rabin, 2002). Cox (2004) employs a three-game (or triadic) design to decompose trust from altruism and reciprocity from altruism or inequality aversion. We use a measure of other-regarding preferences which social psychologists describe

as capturing a range of preferences from competition through altruism (see, for example, the development of a measure of social value orientation by Griesinger and Livingston, 1973, and Liebrand, 1984) in an attempt to account for variation in trust and trustworthiness in a one-shot Berg et al. (1995) investment game. While this measure has been used to study voluntary contributions to public goods, we have not seen it applied to the trust game.

Eckel and Wilson (2004b) study trust as a risky activity. They note (p. 448) that “While many researchers appear to accept this relationship between risk and trust, the relationship between the risk orientation of the trustor and trusting behavior has not been explicitly studied.” Ashraf et al. (2003) and Eckel and Wilson (2004b) conduct experiments that include behavioral risk measures and report no statistical relationship between behavioral risk measures and the decision to trust.¹ We use the results of a series of lotteries to construct a continuous measure of risk attitude, similar to that used by Fellner and Maciejovsky (2007), for the participants in our investment game, and use this risk measure to augment our measure of other-regarding preferences to understand the variation in our trust data.

The statistical analysis in this paper indicates that the social value orientation measure significantly accounts for variation in trust and reciprocity. Furthermore, risk attitudes as we have measured them do not significantly explain variation in trusting behavior using the aggregated data, which is consistent with the findings of Eckel and Wilson (2004b), who use a different measure of risk attitudes than what we use. However, we do find a significant positive relationship between risk attitudes and trust for participants whose social value orientations are

¹ In the one-shot version of the investment game senders take a risk by sending some positive amount of money to the receivers.

neither strongly pro-social nor pro-self.² This disaggregation of the social value orientation measure permits us to identify a notable relationship between risk attitude and trust which has not been identified in the literature.

2. Hypotheses regarding social value orientations and risk attitudes in an investment game

2.1. The investment game

The one-shot investment game used by Berg et al. (1995) begins with two individuals endowed with some amount of laboratory currency. One individual, the sender, has the opportunity to send none, some or all of his endowment to the other individual. The amount that is sent is tripled. The second individual, the receiver, now has the opportunity to send none, some or all of the laboratory currency in her control back to the sender. The proportion of the sender's endowment that is sent, or invested, is identified as a measure of the sender's *trust*. The proportion of the tripled investment that is returned to the sender is identified as a measure of the receiver's *trustworthiness* or *reciprocity*.

2.2. Social value orientations

It is possible that the attitudes of the senders and receivers with regard to other individuals may affect the trust and trustworthiness that is exhibited in an investment game. If we could measure attitudes with respect to pro-self or pro-social behavior, it may be possible to better understand the level of trust and trustworthiness that emerges from the investment game. Pro-self behavior may reduce trust and trustworthiness. If individuals think of others as being similar to themselves, pro-self senders may expect receivers to be unlikely to reciprocate in the investment game, and so pro-self senders will be less likely to invest and will therefore be identified as less trusting. Similarly, pro-social senders may anticipate receivers to be trustworthy and reciprocate

² We thank an anonymous referee for suggesting this disaggregated analysis of risk attitudes.

by returning more than the initial investment, and so pro-social senders will be identified as more trusting. With respect to trustworthiness, pro-social receivers may be more likely to share larger portions of the grossed up investment with the sender than may pro-self receivers.

We use the *Decomposed (Ring) Game* mechanism developed by Griesinger and Livingston (1973) and Liebrand (1984) to measure subjects' social value orientations.³ In this game, each subject was paired at random for the entire game with a different, but anonymous, person who was participating in the same session. The subjects were told that neither of the two persons who were paired together would receive any information about the other person's decisions during the session. However, each subject knew that the actions of that anonymous person would contribute to the subject's final payoff.

Each subject was presented with twenty-four pairs of adjacent equally spaced coordinates from a circle with the origin at 0 and a radius of 100 laboratory lira (see Fig. 1).⁴ Each pair of coordinates allocates an amount of money to the decision-maker and another amount to the anonymous subject with whom the decision-maker is paired. An example of a choice facing a participant is the opportunity to receive 100 laboratory lira (L£) while her anonymous partner receives L£0 or the participant could receive L£97 and provide L£26 to her anonymous partner. All subjects are presented with the same

³ The *ring game* has been used extensively by social psychologists, and we believe it was first introduced to economists by Offerman et al. (1996) who were studying voluntary contributions towards the provision of public goods. The sensitivity of results from this mechanism to the stakes in the game and the location of the origin of the ring are presented in Buckley et al. (2001). Recent papers by Carpenter (2003), Buckley et al. (2003), Burlando and Guala (2005) and Sonnemans et al. (2006) use the results of the *ring game*, or a variant thereof, to understand fairness in bargaining games, investment in research and development and voluntary contributions toward public good provision.

⁴ Participants were paid at the end of their sessions and liras were converted into Canadian dollars at the rate of 20 liras equals 1.00 Canadian dollar. The average payout for this game was about \$11.

choices in the same order.⁵ The horizontal axis in Fig. 1 indicates the amount of money allocated to the subject (x) and the vertical axis indicates the amount of money allocated to the other person (y). Therefore, $x^2 + y^2 = 100^2$.

[Insert Fig. 1 about Here]

The subject's payoff from this game is the sum of the amounts that she allocates to herself over the 24 choices plus the sum that the other person, with whom she is anonymously paired, allocates to her. Each decision a subject makes identifies a vector through the origin of the ring described by Fig. 1. The sum of the vectors defined by each of the decision-maker's 24 choices determines a *motivational vector* whose position within the ring identifies the decision-maker's value orientation. A motivational vector with the slope of unity (45 degrees relative to the horizontal axis in Fig. 1) identifies an individual who is a "perfect" cooperator. If this individual behaves consistently, she will always make a choice that will maximize the total payout to the individual and her anonymous partner. The length of the motivational vector relative to twice the radius of the ring is a measure of the decision-maker's consistency in the identified social value orientation.

Based on observed preferred motivational vectors, individuals can be classified into five categories according to the angle of the motivational vector relative to the horizontal axis in the

⁵ The pairs of coordinates, in the order they occur around the ring in Fig. 1 are (100,0; 97,26), (97,26; 87,50), (87,50; 71,71), (71,71; 50,87), ..., (87,-50; 97,-26), (97,-26; 100,0). The order in which the pairs were presented to the participants was randomized. Once the new order was determined, we randomly selected half of the pairs and reversed the order of the coordinates. The same final ordering was presented to each of the participants.

positive quadrant of the ring.⁶ Individuals with vectors lying between 67.5 and 112.5 degrees are classified as *altruistic*. These individuals are prepared to give up more money to benefit another than the other individual gains. At the other extreme, individuals with vectors between -112.5 and -67.5 degrees are classified as *aggressive*. These individuals are prepared to give up resources in order to impose resource reductions on others and their losses will be less than what others will lose. The middle positions are held by *cooperators*, with vectors between 22.5 and 67.5 degrees, *individualists*, with vectors between -22.5 and 22.5 degrees and *competitors*, with vectors between -67.5 and -22.5 degrees. The cooperators will select income distributions which maximize the joint payout to the two individuals, the individualists will select the income distributions which will maximize their own payouts, and the competitors will select income distributions which will maximize their income relative to the other individual's income.

Individuals' choices in the ring game and the resulting measure of social value orientations may provide some guidance in understanding their investment behavior (and ultimately what is identified as a measure of their trust) in the investment game. Sending resources to the receiver in the investment game transfers resources to that individual. The results of the ring game characterize our participants with respect to a relative amount of resources they would provide to a stranger in a non-strategic resource allocation game. The greater an individual's social value orientation measure, the greater the amount of resource that would be added to the receiver's endowment. This leads to the following hypothesis stated in its null form as:

⁶ Alternatively, the angle of the motivational vector can be expressed in radians or the value orientation index can be measured as the slope of the motivational vector, by dividing the total amount each subject assigned to her counterpart by the total amount she selected.

H1: The propensity of individuals to trust in the investment game is independent of their social value orientation.

In a similar way, individuals' choices in the ring game may provide guidance in understanding how they share their gains from the senders' actions. Returning resources to the sender in the investment game transfers resources to that individual. An individual who demonstrates a willingness to transfer more resources to a stranger in a non-strategic ring game may be more willing to return more resources to a stranger in the investment game. The greater an individual's social value orientation measure, the more reciprocity that individual may display. This leads to our next hypothesis stated in its null form as

H2: The propensity to reciprocate in the investment game is independent of the responder's social value orientation.

2.3. Risk attitudes

It is possible that risk attitudes will be related to the identification of trust in the investment game. James (2002) characterizes trust as a risky action taken by an agent to an economic transaction under uncertainty or informational incompleteness with the anticipation that the other agent to the transaction will not behave opportunistically (i.e., will not exploit the vulnerability that the agent has created for himself or herself by taking the risky action). Standard incremental models of trust development (Rempel et al., 1986) suggest that trust initiators should be careful, because trust involves risk. This is especially so in a one-shot investment game where there is no opportunity for investors to retaliate or for recipients to build reputational capital. Therefore, by sending a positive amount to their receivers, individuals take a risk by placing trust in receivers to behave in cooperative and non-exploitative ways (Cook and Cooper, 2003, p. 217). Thus, an

individual's risk attitude is expected to have an impact on the individual's expression of trust, where risk seekers relative to risk-averse individuals are likely to be more trusting and contribute more in the investment game.⁷

To elicit subjects' risk preferences, we used the two-stage lottery mechanism developed by Becker et al. (1964). In the first stage, subjects were presented with a lottery gain prospect to win a prize of 100 laboratory francs with probability p , and zero laboratory francs with probability $(1-p)$.⁸ We elicited subjects' certainty equivalents for each lottery by offering them the opportunity to sell back the lottery to the experimenter for certain cash. We asked subjects to determine the *minimum selling price* that they would be willing to accept in exchange for the chance of winning the 100 francs prize with a specified probability. To determine whether subjects would sell the lottery for the selling price they set or play the lottery, we drew a card at random from a shuffled deck of 100 cards. These cards are printed with values from 1 franc to 100 francs. If the amount shown on the card was equal to or greater than their stated minimum selling price, the subject would receive the amount shown on the card and give up the lottery to the experimenter; otherwise the subject would play the lottery at the specified probability of winning the prize. Finally, for those who played the lottery in a given trial, we drew another

⁷ In related literature, Eckel and Wilson (2004b) conduct experiments that include two behavioral risk measures and one survey measure of risk attitudes and report no statistical relationship between behavioral risk measures and the decision to trust. They report a weak relationship between risk measured from the survey and the decision to trust. Ashraf et al. (2003) also do not find any relationship between risk preferences revealed in a risky-choice task and trust decisions in the investment game. Bohnet and Zeckhauser (2004) find that individuals are much more willing to take risks when the outcome is due to chance than when it depends on whether another player proves trustworthy. According to Bohnet and Zeckhauser (2004), trusting may lead to betrayal costs that are shown to be above and beyond mere monetary losses.

⁸ Participants were paid at the end of their sessions and francs were converted into Canadian dollars at the rate of 100 francs equals 1.00 Canadian dollar. The average payoff for the 24 lotteries in which each subject participated was about \$13. The dollar value of the maximum lottery payoff is low, but the payoffs in the investment game also are relatively low. Accordingly, it is unlikely that the risk attitudes that are obtained from the lottery experiment will be unrepresentative of the attitudes which characterize behavior in the investment game.

card from a different deck which had 100 cards, numbered from 1 to 100. If the number shown on the card drawn was equal to or smaller than the probability of winning, those who played the lottery would win and receive 100 francs; otherwise they would *lose* the lottery and get paid nothing for that round.

The lottery game was played for 25 rounds.⁹ The various rounds presented different chances of winning the lotteries, ranging from 5 percent to 95 percent. The sequence of the last 24 rounds was the same as that used by Harrison (1986) and Kachelmeier and Shehata (1992). The expected values (EV) of the 24 lotteries presenting the opportunities to win a prize of 100 francs and their certainty equivalents (CE) were used to determine a risk variable that reflects the intensity of an individual's preference for risk-seeking behavior.

To capture risk-seeking attitudes we record the frequency, ϕ , with which an individual reports the CE greater than the EV for each of the 24 lotteries confronted. The greater the ϕ (which can range from 0 to 24), the greater is our confidence in characterizing the individual as a risk seeker. This is similar to the risk attitude measure that is used by Fellner and Maciejovsky (2007).

We chose to measure risk attitudes this way, rather than use the individual data to generate a parameter from an underlying model of behavior (such as by fitting the individual data to a general utility function that would be characterized as exhibiting constant relative risk aversion and using the risk coefficient as our risk attitude measure) because the resulting parameters would each be characterized by a variance. With each individual's risk attitude

⁹ The first round presented the subjects with even odds of winning 100 francs. Consistent with previous literature, this round was treated as a training round for the subjects.

defined as a parameter and a variance, it would be difficult to generate a continuous measure of risk attitude, although we could categorize individuals as risk-averse, risk-neutral and risk-seeking. Using the continuous measure of $0 \leq \phi \leq 24$ provides a finer classification of relative risk attitudes than we would obtain if we use the three risk categories of risk-avoiding, risk-neutral and risk-seeking.¹⁰

In the one-shot version of the investment game senders take a risk by sending some positive amount of money to the receivers. However, receivers face no risk when deciding how much money, if any, to return. Therefore, risk preferences have no role in explaining variation in reciprocity in a one-shot investment game. This leads to the following hypothesis stated in its null form as

H3: The propensity to trust in the investment game is independent of investor's risk preference.

3. Experimental protocol

A total of 182 subjects (100 men and 82 women) were recruited from undergraduate business classes at a medium-sized university. During the recruitment phase, students were told that the experiment involves simple decision-making, and that the details would be given to them during the session. In addition, they were told that they were required to participate in two separate sessions. Each session would be conducted on a different day and each session would last no more than two and one-half hours. They were also informed that during the course of the sessions they would earn money that would be paid to them in cash at the conclusion of each session.

¹⁰ At the time we began this project we were not familiar with the Holt and Laury (2002) mechanism. Had we been familiar with this, we would have generated risk attitudes using their mechanism.

3.1. The first session (eliciting social value orientations and risk attitudes)

In the first session, we elicited subjects' social value orientations and risk attitudes. This allows us to isolate intrinsic individual characteristics rather than assume that our subjects are risk-neutral, non-cooperative profit maximizers.

We conducted nine sessions with groups ranging from 12 to 26 people. Each session lasted approximately 90 minutes. Subjects were paid for each decision they made in the ring game and for the outcome of each lottery for which they reported a certainty equivalence. Subjects earned an average of \$24 (about \$11 for the ring game and \$13 for the lotteries). At the start of each of these sessions, each subject was assigned a random identification number by drawing a number from a hat that included "N" index cards numbered from 1 to N, where N was the total number of participants in the session. Subjects were instructed to keep their subject identification numbers confidential and not to share them with others.

The participants were randomly seated in alternate rows of a large lecture theatre and were separated by several seats within each row. Each choice that the participants had to make in the ring game and in the lottery game was displayed on a large screen at the front of the lecture hall. The participants made their choice of income allocation for the ring game or indicated their certainty equivalents for the lotteries and recorded them on their record sheets. After each decision was made, a new set of income allocations or lottery was displayed on the screen. At the conclusion of each of the first sessions, subjects were asked to sign up for the second session by selecting from a range of different time slots.¹¹

¹¹ All 182 individuals returned to participate in the investment game. Instructions used to elicit risk preferences and value orientations are available from the authors upon request.

3.2. The second session (playing the investment game)

The second experiment consisted of a series of rounds of a computer mediated investment game. In this paper we are reporting the results from only the first two rounds.¹² Half of the participants played the role of the sender (trustor) in the first round. The participants were reassigned to different partners for the second round, during which the people who were responders in the first round took the role of sender.

At the beginning of the session each subject was assigned an identification number (i.e., their experimental identities) by drawing an index card from a set of shuffled cards numbered from 1 to N , where N is the total number of the people attending the session. Students were told that their identification numbers were private information and that they should not show them to or share them with any one. Individuals were then told to select a computer work station at which they would remain for the duration of the session. After the participants were seated, the instructions were shown on the screens of the participants' monitors and read aloud to them by the experimenters. Subjects were given an opportunity to ask questions for clarification.

At the beginning of each decision-round, subjects were endowed with 100 laboratory euros and were told whether they would assume the role of a sender or a receiver for the round.¹³ Senders were asked to make a decision about how much of their endowment they wished to invest with the person with whom they were paired. They

¹² The experiment consisted of 20 decision rounds and four distinct treatments, three of which involved repeated rounds in which the sender and receiver remained matched. Only the results of the one-shot games are reported here.

¹³ Participants were paid at the end of their sessions and euros were converted into Canadian dollars at the rate of 100 euros equals 1.00 Canadian dollar. Instructions for the investment game are available from the authors upon request.

were told that they have the choice of investing some, all, or none of their endowment. They were instructed to enter this number on the appropriate place on their computer screen. This investment was multiplied by three and reported to the person with whom the sender was paired (the receiver). After the receivers received this information, they decided how much of the resources they controlled (the sum of their own endowment *plus* three times any investment made by the sender) they would return to the senders.¹⁴ Receivers entered this amount onto their computer screen through their keyboards. These values were reported to the senders and the total payoffs to the senders and receivers appeared on their screens. Each participant could calculate what the other person received, but was not explicitly told this value.

Individuals were then rematched and a second round of sending and responding took place.¹⁵ After the second round, additional rounds were played, implementing different treatments. At the end of the session, subjects completed a short questionnaire. The purpose of this questionnaire was to collect background information as well as information concerning the

¹⁴ The basic structure of the experimental setting is a variant of the trust game developed by Berg, Dickhaut and McCabe (1995). The resolution of this game is simple. In the one-shot version of the game, the receiver should not send any money back knowing that the game ends immediately thereafter. The sender, anticipating the receiver's decision, should send no money to the receiver in the first place. However, Berg et al. (1995), Croson and Buchan (1999) and several other studies have shown that the actual behavior is quite different from the one predicted above. The senders send on average a significant positive sum to the receiver, thus exhibiting some "trust" in the receiver (the average percentage reported in one-shot games by Berg et al. (1995), Chaudhuri and Gangadharan ((2004), Cochara et al. (2004), Cox (2004), Croson and Buchan (1999) and Eckel and Wilson (2004a) are in the range 0.43 – 0.68). The receiver reciprocates this trust by sending some money back (the average percentage reciprocity reported the studies just cited are in the range 0.17 – 0.49). By sending money back to the original sender, the receiver exhibits positive "reciprocity".

¹⁵ Identification numbers were paired randomly and the matches were made for each round in a session prior to the start of the session. Because participants selected their identification numbers at the start of the session, there was no way that the experimenters could know who was being paired with whom. Participants did not know whether they were paired with men or women, nor did the experimenters know about these pairings during the session. The only restriction on the pairings was that pairs would never be repeated during the session.

subjects' perceptions of the session in which they participated. Subjects were then paid privately and dismissed.¹⁶

4. Descriptive statistics for social value orientations and risk attitudes

4.1. Social value orientations

The mean consistency measure for our participants (measured as the length of the motivation vector divided by twice the radius of the ring) exceeded 0.90. This is considered to be very consistent behavior (see Buckley et al., 2001). For convenience of reporting the summary data we have created three categories of social value orientations. The first category contains individuals whose motivational vector is less than 0.196 radians. This includes individualists and competitors. This category is clearly the pro-self category. The second category contains individuals whose motivational vector exceeds 0.589 radians. This includes cooperators and altruists and is clearly the pro-social category. The third category includes individuals who are in neither of the other two. It includes individualists, who are closer to cooperators than the clearly pro-self individuals and it includes cooperators who are closer to individualists than to altruists. The mean motivational vector for the 100 men in the sample is 0.476. The mean for the 82 women is 0.240. This difference is statistically significant ($t = 0.000$ from OLS regression using continuous social value orientation measures) and the Spearman's ρ is 0.29 ($p = 0.000$) indicating there is a positive correlation between men and social value

¹⁶ After the second round, additional rounds were played, implementing different treatments, which are not reported in this paper. The average earnings per subject for the second session were \$34 for total average earnings of \$58 over the two sessions. The average earnings for the two rounds reported in this paper were about \$3.25. The two rounds were completed in less than 5 minutes.

orientation. With respect to the three categories described above, overall, the distribution of value orientations is bimodal. 37 percent of individuals are in the competitors/individualists category and 38 percent are in the cooperators/altruists category.¹⁷ More than twice as many men as women display value orientations in the pro-social category (49 men versus 21 women) and more than twice as many women as men display value orientations in the pro-self category (46 women versus 22 men).¹⁸ In this sample of subjects, there is a difference in the measured social value orientations of men and women.¹⁹

4.2. *Risk attitudes*

In the analysis that follows, risk attitudes will be represented as ϕ , taking on the integer values from 0 to 24.²⁰ The mean value of ϕ is 14 and the median is 15. One third of the observations

¹⁷ Typically, value orientation data are summarized using the categories competitors, individualists, and cooperators. Small numbers occur in the aggressor and altruist categories and these are frequently included in the competitor and cooperator categories, respectively. The sample of participants whose data are reported here are distributed across the categories of cooperators, individualists and competitors in the proportions 0.49, 0.49 and 0.02. Data presented by Burlando and Guala (2005), Carpenter (2003), Buckley et al. (2001) and Offerman et al. (1996) display proportions for cooperators, individualists and competitors that are in the ranges 0.53 – 0.22, 0.75 – 0.32 and 0.12 – 0.02. The categories reported here are chosen to better reflect the distributions of the value orientation scores than would the more conventional categories.

¹⁸ None of Burlando and Guala (2005), Carpenter (2003), Buckley et al. (2001) or Offerman et al. (1996) report distributions separately for men and women. Liebrand and van Run (1985) report “no significant differences [between males and females] in the distribution of social motives” in their study of social motives and behavior in social dilemmas as well as in Liebrand (1984). Perugini, Tan and Zizzo (2005) report that 55 percent of women are cooperators while 47 percent of men are cooperators.

¹⁹ A recent result reported by Aguiar et al. (2008) argues that women are expected to be more generous in a dictator game than men. They conclude “if women are expected to be less competitive, this may result in less job opportunities for women in highly competitive environments (usually the most well-paid) [and] ... if women are perceived to be more generous, this may lead to labor segregation (with women predominantly being offered caretaker jobs)...” If this is a common perception, then the results we observed from our sample of 82 women in an undergraduate program in business may in fact be consistent with an attempt on the part of women studying to enter the competitive world of business to *act like men*. This may be an explanation for the strongly pro-self social value orientations generated by our sample of women.

²⁰ This is comparable to the measure of risk aversion used by Fellner and Maciejovsky (2007), who are particularly interested in individuals who are risk averse or risk neutral and use as their measure of risk attitude the frequency

lie below 11 and one-third of the observations lie above 18. The median value of ϕ for women is 12 (the mean is 12.63), for men it is 16 (the mean is 15.29). This difference is statistically significant ($t = 0.000$ from an OLS regression using ϕ as a continuous measure) and the Spearman's ρ is 0.20 ($p = 0.007$) indicating there is a positive correlation between men and risk-seeking attitudes. Moving from the low risk-seeking attitudes ($\phi < 11$) to intermediate risk-seeking attitudes ($11 \leq \phi \leq 18$) to the high-risk seeking attitudes ($\phi > 18$), the proportion of women in each of the three categories falls. The opposite pattern is displayed by the men. Again, there is clearly a difference between the risk attitudes of men and women.²¹

4.3. *Risk attitudes, social value orientations and gender*

The data reported in section 3.1 indicated that in this sample men displayed higher social value orientation scores than did women. Combining risk attitudes and social value orientation scores, while there is a small positive relationship between risk-seeking attitudes and pro-social value orientations, the relationship is not statistically significant ($p = 0.317$ from an OLS regression and $p = 0.224$ for the Spearman's ρ of 0.09).

However, data show that given risk attitudes, men tend to display significantly more cooperative behavior than women ($p = 0.000$, $p = 0.055$ and $p = 0.000$ for low risk-seeking, moderate risk-seeking and high risk-seeking individuals). The mean value orientations of low and high risk-seeking men (0.50 and 0.54) are significantly above the 0.392 radian cutoff for characterizing value orientations as cooperative ($p = 0.025$, $p = 0.000$) and not significantly different from the boundary value for moderate risk-seeking

with which their participants select the certain outcome when presented with seven pairs of lotteries and certain outcomes, for which the certain outcomes are equal to the expected values of the lotteries.

men (0.39). Women, however, display mean value orientations that are significantly below the 0.392 radian cutoffs for low, moderate and high risk-seeking categories (0.28, 0.25 and 0.18, $p < 0.01$ in all cases). If the data from men and women are viewed separately, there is no significant relationship between increasing risk-seeking attitudes and increasing social value orientations. This is supported by both OLS regressions of social value orientations as a function of risk or with reference to the calculation of Spearman's ρ for men and women (in all cases and either test, $p > 0.35$) and is consistent with the aggregated data. There are clear differences in value orientation measures of men and women by risk category but there is no statistically significant relationship between the risk attitude and social value orientation measures.

5. Results

5.1. *Trust*

On average men are more trusting than women in this sample. Men pass on about 68 percent of their endowments while women pass on about 51 percent. The difference is significant ($p = 0.004$). Fig. 2 summarizes trust for men and women with a normalized frequency distribution. It is clear that trust is distributed differently across men and women. The distribution for men is bimodal and that for women has a modal range of 0.50 to 0.66.

[Insert Fig. 2 about Here]

The full model of trusting behavior includes four variables (order, risk, social value orientation and gender) and two interactions (gender with risk and gender with

²¹ This is a common result. See Charness and Gneezy (2007) for some new results and a survey of earlier work that show women are less risk-seeking than men in comparable situations.

social value orientation). Order is included as a design variable to account for any order effects introduced by having half of the participants play the role of the sender in the investment game in the first round while the remaining participants are receivers and then rematching participants and having the receivers from the first round play the role of sender and the senders from the first round play the role of receiver. No participant was paired with the same individual in each round. Because there may be some effect on trust due to the experience of participating in the game in a different role, it is necessary to control for this.

Two continuous variables are included in an attempt to account for differences in trusting behavior associated with the risk attitudes (Risk) that the participants may have and for differences which may be attributed to different social value orientations (VO). The fourth variable (Gender) identifies whether the participant is a man or a woman.²² This variable is included to account for any differences between men and women which may remain after accounting for differences between participants that can be associated with risk attitudes and social value orientations. Because of the differences we found between the risk-seeking measures and social value orientation measures of men and women, we have included the interaction between Gender and VO and the interaction between Gender and Risk in our regression. Table 1 presents tobit regression results for the full model of trusting behavior.

[Insert Table 1 about Here]

²² The variable is defined as Gender because when demographic information was collected from participants, they were asked to identify their gender as male or female. Of the demographic information collected from participants, whether they were male or female was the only information for which we had a conjecture regarding the relationship between it and trust and reciprocity.

The full model is significant (p-value on the χ^2 -statistic = 0.000). The regression coefficients for VO and the interaction of VO and Gender are significant ($p = 0.085$ and $p = 0.071$), suggesting that people with higher social value orientations will exhibit greater trust than people with lower social value orientations and that increases in social value orientation increase trust more for men than for women. Separate tests for the significance of the main effects of Order, Gender and Risk indicate that none is statistically significant ($p = 0.572$, $p = 0.107$ and $p = 0.624$). Only the main effect of VO is significant ($p = 0.000$).

These results support the rejection of H1, that individuals' value orientations have no effect on their trusting behavior in favor of the alternative hypothesis that higher value orientation scores will promote trust. The results also support maintaining the null hypotheses H3, that risk attitudes will not affect trusting behavior.

The regression results do not reveal everything in this data. Table 2 presents mean trust measures by risk attitude category and social value orientation category. The row totals indicate that trust increases as the value orientation measure increases (as individuals become more cooperative). This is consistent with the regression results. Column totals indicate that there is little affect of risk seeking on trusting behavior. This is also consistent with the regression results. Examining the interior cells of Table 2 suggests that there may be a significant relationship between trust and risk-seeking attitudes for a specific category of individuals. The pattern of change across risk attitudes is not the same by social value orientation category. Trust appears to be relatively stable across risk-seeking categories for the pro-self (46, 43 and 46 percent sent as the risk-

seeking attitudes rise) and pro-social individuals (64, 75 and 64 percent sent as the risk-seeking attitudes rise). For the individuals in the intermediate group, with social value orientation motivational vectors between 0.196 and 0.589 radian, the percent of endowment rises from 46 percent to 59 percent to 63 percent. The results of tobit regressions indicate that for pro-self senders, the negative relationship between sender's trust and risk parameter ϕ is not significant ($p = 0.591$), for pro-social senders, the positive relationship is not significant ($p = 0.432$) and for senders in the intermediate category, the positive relationship is significant ($p = 0.049$).²³ While there is not a significant relationship between trust and risk-seeking attitudes for the pro-self and pro-social individuals, there is a significant positive relationship between trust and risk-seeking for people in the intermediate social value orientation category. This will be discussed further in the concluding section.

5.2. *Reciprocity*

Typically, reciprocity is measured as the percent of the tripled investment returned by the responder to the sender. This has a maximum value of unity and minimum value of zero. It is possible for this percentage to be undefined if the sender invests nothing.²⁴ On average women are slightly more trustworthy than men in this sample. Men return about 37 percent of the sender's grossed-up investment while women return about 38 percent. The difference is not statistically significant ($p = 0.930$).

²³ The Spearman ρ s representing the relationships between the percentage sent by an individual and the individual's risk-seeking measure, ϕ , by social value orientation categories are -0.6, 0.33 and 0.07 for the pro-self, intermediate, and pro-social categories. The corresponding p-values are 0.63, 0.03 and 0.57.

²⁴ In this case the observation is omitted from the analysis and the sample size will be reduced from 182. This occurs six times.

The full model of reciprocity includes four variables (Order, Gender, VO and sender's trust) and three interactions (Gender with VO, Gender with sender's trust and VO with sender's trust).

The new continuous variable included in the model of reciprocity is the level of trusting behavior that the responders may experience from senders (Trust). There is no need to augment the reciprocity model with a variable which accounts for risk attitudes. As noted earlier, the decision regarding the amount of resources to return to the sender is not a risky decision for the responder within the context of the one-shot game.

Because of the differences we found between the social value orientation measures of men and women, the relationships between trust and men and women and between social value orientations and trust, we have included the interaction between Gender and VO, Trust and Gender and VO and Trust in our regression.²⁵ Table 3 presents tobit regression results for the full model.

[Insert Table 3 about Here]

The full model is significant (p-value on the χ^2 -statistic = 0.042). The significant regression coefficients belong to VO, Trust and the interaction between VO and Trust (p = 0.024, p = 0.097 and p = 0.001). Separate tests for the significance of the main effects of Order, Gender, VO and Trust indicate that neither of the first two are statistically significant (p = 0.130 and p = 0.605) but the last two are significant (p = 0.011 and p = 0.015). These results support the rejection of H2, that individuals' value orientations

²⁵ Because men and women exhibit different trust behavior, we conjecture that men and women may respond differently as a receiver to the trust exhibited by others. Because trust is affected by an individual's social value orientation, the trust of a sender may be viewed differently by individuals with different social value orientations.

have no affect on their reciprocity in favor of the alternative hypothesis that higher value orientation scores will promote reciprocity. In addition, the results support previous findings that the trusting behavior of senders has a positive effect on reciprocity. Furthermore, we find that there is a significant statistical interaction between the value orientation of the responder and the trust of the sender; these work together to increase reciprocity. Trust begets reciprocity by more than their simple main effects.

Table 4 presents mean reciprocity measures by value orientation category and a category identifying the level of the sender's trust. A common conjecture, and a result that has been obtained in laboratory environments, is that reciprocity is influenced by the trust expressed by the sender, with responders showing greater reciprocity to more trusting investors. This is a result that was described above, based on the regression results. The column totals in Table 4 indicate that there may be a small negative affect of trusting behavior on reciprocity. Examining the interior cells of Table 4 suggests that there may be a significant interaction effect on reciprocity due to trusting behavior and value orientation. In particular, there is a relatively substantial increase in reciprocity for high value orientation individuals as investors become more trusting. Just the reverse is reflected by the data for individuals who are least cooperative. The results in Table 4 with respect to the categorical data are supported by statistical results which compare reciprocity and the sender's trust by value orientation category. For pro-self receivers, the negative relationship between sender's trust and reciprocity is significant ($p = 0.010$), for pro-social receivers the positive relationship is marginally significant ($p = 0.086$) and for receivers in the intermediate category, we cannot reject the null hypothesis that the

sender's trust does not influence the receiver's reciprocity ($p = 0.880$).²⁶ These results will be discussed further in the concluding section.

6. Conclusion

The primary objective of this paper was to add to the experimental evidence on the role of other regarding behavior and risk preferences on trust and reciprocity in a one-shot investment game environment. To achieve this objective, we explicitly elicited and measured for 182 participants their social value orientations using the decomposed (ring) game and their risk preference using Becker et al. (1964) the two-stage lottery mechanism. These two measurements are regressed on subjects' trust and reciprocity behaviour observed in the investment game.

The results provide evidence suggesting that the social value orientation measure we used accounts for a significant portion of the variation in trust. Individuals who reveal themselves to be more willing to transfer resources to others in the ring game tend to be more trusting. The analysis in the paper further provides evidence of the importance of social value orientation in explaining reciprocal behavior at standard significance levels. However, the analysis in the paper leads to a rejection of the role of risk in generally explaining trust at standard significance levels, consistent with Ashraf et al. (2003) and Eckel and Wilson (2004b). However, when we focus our attention on individuals whose social value orientations were neither strongly pro-social nor strongly pro-self, we find that as risk-seeking attitudes increase, the level of trust exhibited by these individuals increases. This relationship is significant. This result suggests that

²⁶ The Spearman ρ s representing the relationships between the percentage returned by an individual and the trust expressed by the sender by social value orientation categories are -0.24, 0.07 and 0.20 for the pro-self, intermediate, and pro-social categories. The corresponding p-values are 0.06, 0.68 and 0.10.

strongly pro-self and strongly pro-social individuals are not significantly affected by risk when making an investment (or trust related) decision. These individuals will be relatively less trusting or more trusting regardless of their risk attitudes, while the individuals whose pro-social tendencies are intermediate will be influenced by their risk attitudes. This differentiation of trust behavior according to the nature of the decision-maker's social value orientation and risk attitude is unique to this study.

Finally, our results support the literature regarding the importance of trusting behavior by senders on the reciprocal behavior of responders in the investment game. We find that there is a significant statistical interaction between the social value orientation of the responder and the trust of the sender. The general analysis suggests that trust and social value orientation work together to increase reciprocity and that trust and social value orientation beget reciprocity by more than their simple main effects, the result is more complex. The disaggregated data in Table 4 indicate that the interaction between social value orientations of the receiver and the trust of the sender exhibits a significant negative relationship for strongly pro-self individuals and a significant positive relationship for strongly pro-social individuals. There is neither a consistent positive nor negative relationship between reciprocity and the sender's trust for individuals with neither strong pro-social nor pro-self values.

The conventional result of increasing reciprocity with increasing sender's trust is clearly the case for strongly pro-social individuals. Fig. 3 displays the fitted values of reciprocity versus the sender's trust as well as the ninety percent confidence interval around the fitted values for strongly pro-social receivers. The return that a sender might

expect from a pro-social receiver for any amount sent is at least equal to what is sent. Considering the range of values included within the 90 percent confidence band, any amount sent that exceeds 40 percent of the sender's endowment is likely to result in a return that exceeds what is sent (at the 5 percent level).

The reverse is the case for strongly pro-self individuals. Generally, pro-self individuals send, on average, at least as much back to senders as the senders invested with the receivers (in Table 4, the row total for pro-self individuals exceeds 0.33, which is the reciprocity value that would let the sender profit from trusting the receiver) . However, the reciprocity measure is the proportion of the grossed-up investment that is returned. This falls as the sender's trust increases. Fig. 4 displays the fitted values of reciprocity versus the sender's trust as well as the ninety percent confidence interval around the fitted values for strongly pro-self receivers. The return that a sender might expect from a pro-self receiver is at least equal to what is sent as long as the sender invests something below 74 percent of endowment. Considering the range of values within the 90 percent confidence band, any amount sent that exceeds about 57 percent of the sender's endowment is likely to result in a return that falls short of what is sent (at the 5 percent level). As might be expected, pro-self individuals keep larger and larger proportions of the grossed-up investment as the grossed-up investment rises. This contributes to the positive interaction between social value orientation and sender's trust and is not fully revealed without viewing the disaggregated data by distinct social value orientation categories.

The paper contributes to the literature on trust and reciprocity by examining a social value orientation measure that has not been used in prior studies on trust and trustworthiness. The disaggregation of this measure into several categories of social value orientations as well as the risk measure used, permits us to generate results that generally support existing results, but also permits us to identify some new results with respect to trust and risk and with respect to reciprocity and other regarding preferences.

Acknowledgements

We thank Amin Amershi, Theresa Libby, Gerry Lobo, Andy Muller, Sean Robb and other participants of the *2nd McMaster University - DeGroote Summer Research Conference*, the participants of the *2nd European Institute for Advanced Studies in Management (EIASM) Workshop on Trust*, the *2004 Annual Conference of the American Accounting Association*, the participants at a 2005 research workshop at the Indian School of Business, the participants at a 2006 workshop in the Department of Social Sciences at the University of New Brunswick at Saint John, Mary-Anne Sillimaa and two anonymous referees for their comments. We gratefully acknowledge financial support from the *Social Sciences and Humanities Research Council of Canada (SSHRC)*. The usual disclaimer applies.

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Table 1. Tobit Regression for Trust

Variables	Coefficient	Std. Error	p-value
Constant	0.465	0.090	0.000
Order	0.031	0.055	0.572
Gender	- 0.101	0.139	0.469
VO	0.175	0.101	0.085
Risk	- 0.001	0.006	0.861
Gender x VO	0.269	0.148	0.071
Gender x Risk	0.007	0.008	0.425
Number of Observations	182		
Log Likelihood	- 96.88		
LR chi2 (6)	30.30		
Prob > chi2	0.000		
Pseudo R2	0.135		

Note: Order is 1 for a sender in the first round and 0 otherwise; Gender is 1 for a man and 0 for a woman. VO and Risk are continuous variables.

Table 2.

Trust: Mean percent of endowment invested by value orientation and risk attitude

Value Orientation	Risk Attitude			Row Total
	Low Risk Seeking	Moderate Risk Seeking	High Risk Seeking	
Competitor/Individualist VO measure less than or equal to 0.196 radians	46.19 (29.36) [21]	43.11 (22.41) [27]	46.25 (26.70) [20]	44.99 (25.63) [68]
Individualist/Cooperator VO measure between 0.196 and 0.589 radians	46.18 (25.28) [17]	59.40 (34.94) [10]	62.94 (25.96) [17]	55.66 (28.35) [44]
Cooperator/Altruist VO measure greater than or equal to 0.589 radians	64.43 (30.62) [23]	75.83 (28.12) [24]	64.57 (35.93) [23]	68.39 (31.67) [70]
Column Total	53.07 (29.68) [61]	58.66 (30.51) [61]	59.19 (30.30) [60]	56.57 (30.35) [182]

Note: Standard deviations are in parentheses and number of observations is in square brackets. Individuals are classified as “low risk seeking” if they select a certainty equivalent (CE) for a lottery greater than the expected value (EV) of the lottery at most ten of 24 times. They are classified as “high risk seeking” if they do this at least 19 of 24 times. People who select $CE > EV$ more than 10 times but less than 19 times are classified as “moderate risk seeking”.

Table 3. Tobit Regressions for Reciprocity

Variables	Full Model		
	Coefficient	Std. Error	p-value
Constant	0.640	0.139	0.000
Order	- 0.104	0.068	0.130
Gender	0.059	0.171	0.730
VO	- 0.558	0.245	0.024
Trust	- 0.340	0.204	0.097
Gender x VO	0.063	0.195	0.747
Gender x Trust	- 0.259	0.259	0.320
VO x Trust	1.094	0.337	0.001
Number of Observations	176		
Log Likelihood	- 129.31		
LR chi2 (6)	14.54		
Prob > chi2	0.042		
Pseudo R2	0.053		

Note: Order is 1 for a sender in the first round and 0 otherwise; Gender is 1 for a man and 0 for a woman. VO and Trust are continuous variables.

Table 4.

Reciprocity: Mean percent of tripled investment returned by value orientation and level of sender's trust

Value Orientation	Level of Sender's Trust			Row Total
	Less than 33 percent	Equal to or More than 33 percent but less than 66 percent	Equal to or More than 66 percent	
Competitor/Individualist VO measure less than or equal to 0.196 radians	53.50 (37.26) [13]	42.67 (30.68) [30]	28.15 (29.88) [21]	40.11 (32.69) [64]
Individualist/Cooperator VO measure between 0.196 and 0.589 radians	51.59 (39.11) [7]	37.43 (27.59) [16]	44.33 (34.96) [20]	42.95 (32.69) [43]
Cooperator/Altruist VO measure greater than or equal to 0.589 radians	37.56 (32.33) [15]	41.68 (33.16) [27]	52.70 (28.29) [27]	45.09 (31.33) [69]
Column Total	46.29 (35.35) [35]	41.16 (30.64) [73]	42.66 (32.11) [68]	42.76 (32.05) [176]

Note: Standard deviations are in parentheses and number of observations is in square brackets.

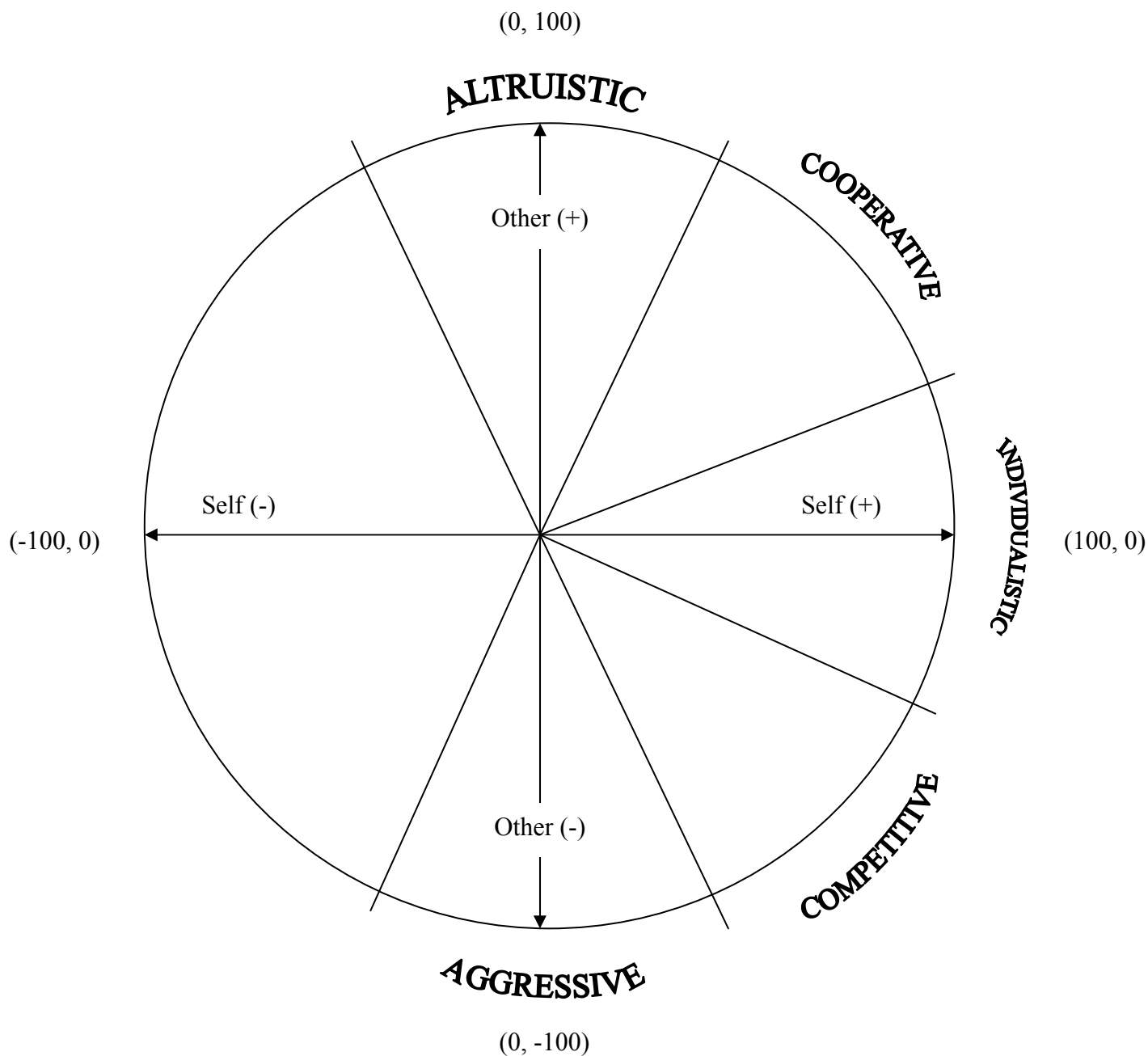


Fig. 1. The value orientation ring

Notes: Individuals with vectors lying between 67.5 and 112.5 degrees are altruistic, with vectors between 22.5 and 67.5 degrees are cooperative, with vectors between -22.5 and 22.5 are individualistic, with vectors lying between -67.5 and -22.5 are competitive and with vectors between -112.5 and -67.5 are aggressive.

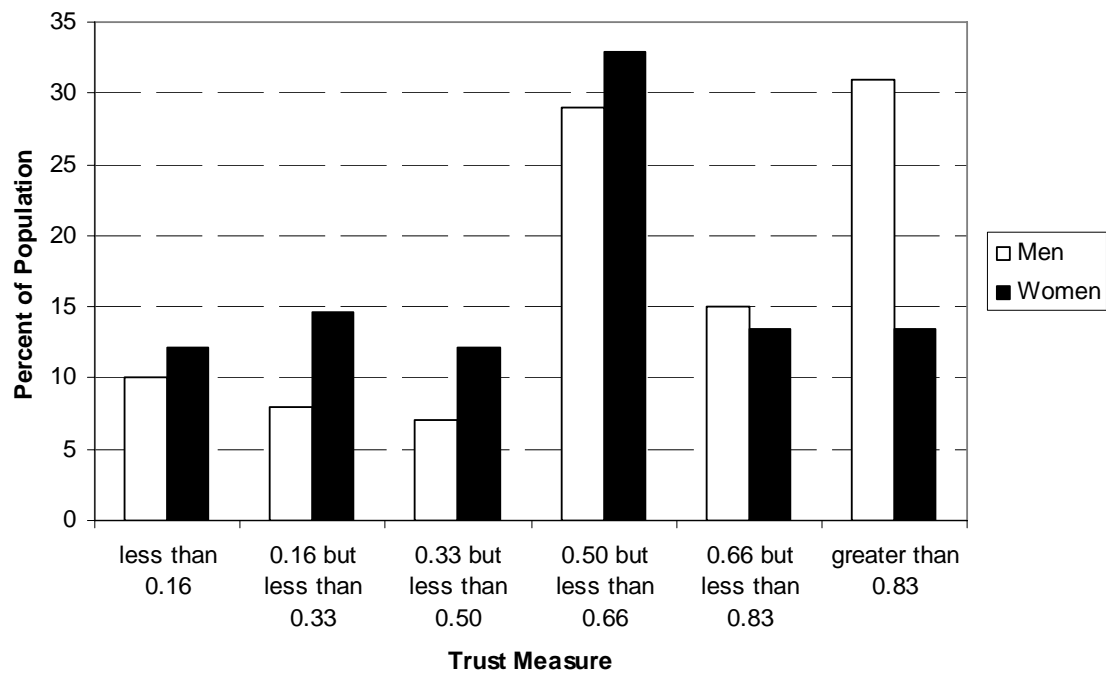


Fig. 2. Men and women categorized by trust measure

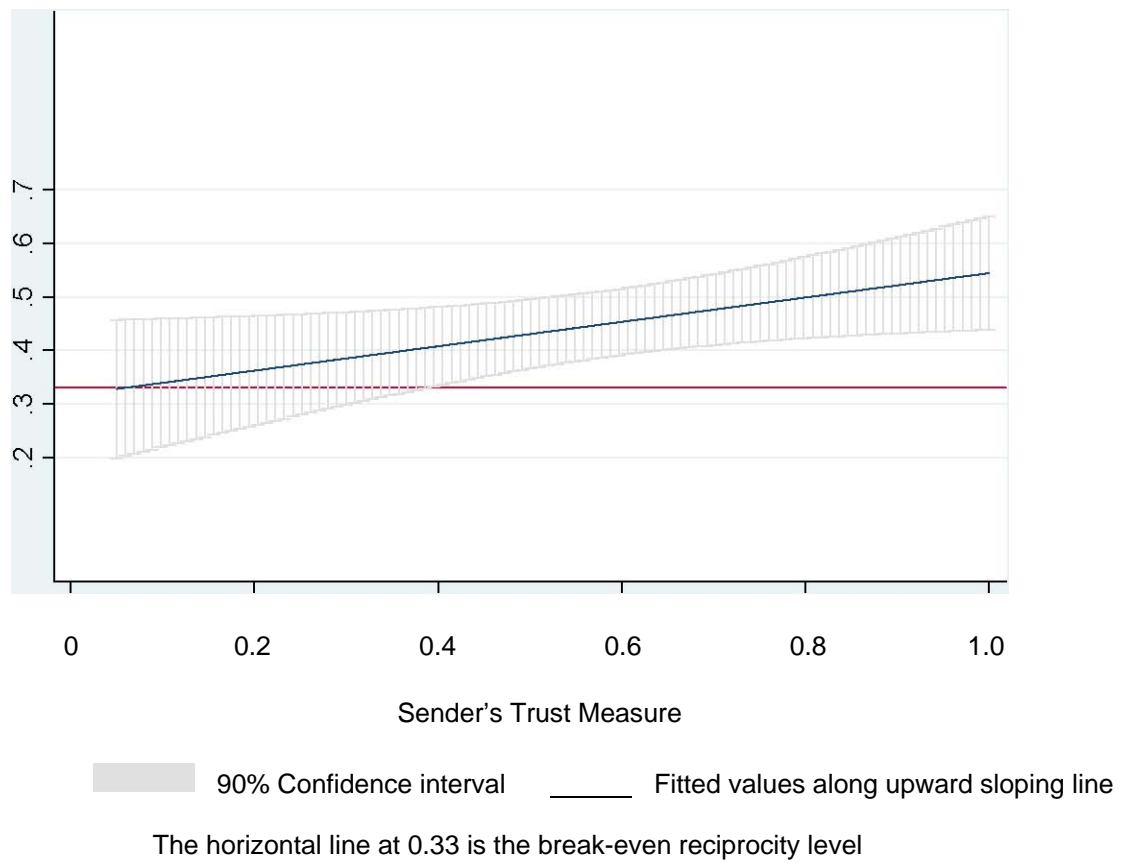


Fig. 3 Reciprocity of strong pro-social receivers, given trust of sender

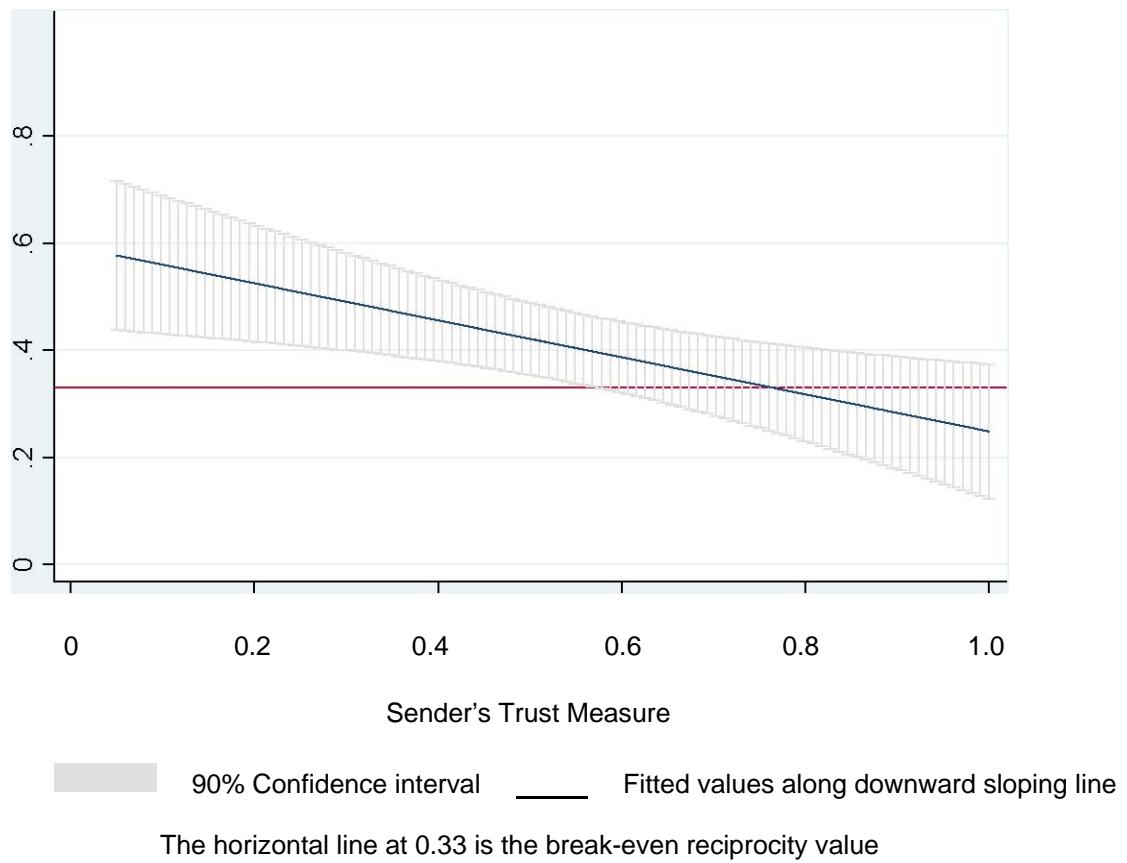


Fig. 4 Reciprocity of strong pro-self receivers, given trust of sender